DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-4 are rejected under 35 U.S.C. 103(a) as being unpatentable over Fujii et al. (WO 2003/052840) in view of Watanabe et al. (US 6153898) and Shimada et al. (US 5802686)

3. With respect to claim 1, Fujii et al. discloses an angular velocity sensor (Fig 15) comprising: a substrate (item 500) made of single crystal silicon (Paragraph 217) and having a tuning fork shape (Fig 15), the substrate including a plurality of arms extending parallel with each other (Fig 15), and a joint section for connecting respecting ends of the arms with each other (Fig 15); a first adhesion layer (Fig 1, item 12) provided on the substrate (Fig 1), the first adhesion layer containing titanium (Paragraph 71); a first electrode layer (item 503) provided on the first adhesion layer (Fig 16), the first electrode containing at least one of titanium and titanium oxide (Paragraph 19); an orientation control layer (item 504) provided on the first electrode layer (Fig 16)l a piezoelectric layer (item 505) provided on the orientation control layer (Fig 16); and a second electrode layer (item 506) provided on the piezoelectric layer (Fig 16).

Fujii et al. does not disclose expressly a barrier layer provided on each of the plurality of arms of the substrate, the barrier layer containing silicon oxide; the first

adhesion layer being provided on the barrier layer, or a second adhesion layer provided on the piezoelectric layer with the second electrode being formed on the second adhesion layer.

Watanabe et al. teaches a piezoelectric device including a barrier layer (item 12) provided on the substrate (Fig 1), the barrier layer containing silicon oxide (column 3, lines 51-60); the adhesion layer (item 13) being formed on the barrier layer (Fig 1).

Shimada et al. teaches a piezoelectric device in which an adhesion layer is provided between the piezoelectric layer and the top electrode layer (column 7, lines 40-50); therefore, Shimada et al. discloses a second adhesion layer provided on a piezoelectric layer and a second electrode provided on the second adhesion layer.

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the barrier layer of Watanabe et al. and the second adhesion layer of Shimada et al. with the angular velocity sensor of Fujii et al. for the benefits of preventing diffusion (column 3, lines 51-60 of Watanabe et al.) and to improve the bond between the piezoelectric layer and the top electrode (column 7, lines 40-50 of Shimada et al.).

4. With respect to claim 2, the combination of Fujii et al., Watanabe et al., and Shimada et al. discloses the angular velocity sensor of claim 1. Fujii et al. discloses that the orientation control layer comprises dielectric oxide material containing Pb and Ti (Paragraph 73).

5. With respect to claim 3, the combination of Fujii et al., Watanabe et al., and Shimada et al. discloses the angular velocity sensor of claim 1. Fujii et al. discloses that

the orientation control layer comprises lead titanate containing at least one of La and Mg (Paragraph 73).

6. With respect to claim 4, the combination of Fujii et al., Watanabe et al., and Shimada et al. discloses the angular velocity sensor of claim 1. Fujii et al. discloses that the piezoelectric layer comprises lead zirconate titanate (Paragraph 230).

7. Claim 10 is rejected under 35 U.S.C. 103(a) as being unpatentable over Fujii et al. in view of Watanabe et al., Shimada et al., and Nakanishi et al. (WO 2004/015370), using Nakanishi et al. (US 2005/0029606) as a translation.

8. With respect to claim 10, the combination of Fujii et al., Watanabe et al., and Shimada et al. discloses the angular velocity sensor of claim 1.

None of Fujii et al., Watanabe et al., or Shimada et al. discloses that the first electrode contains platinum and at least one of titanium and titanium oxide.

Nakanishi et al. teaches a piezoelectric angular velocity sensor (Figs 1 and 7) including a barrier layers (item 2B), adhesion layers (items 2A and 10), and a first electrode (item 2) for a piezoelectric layer (item 3) that contains platinum and at least one of titanium and titanium oxide (Paragraph 63).

At the time of invention, it would have been obvious to a person of ordinary skill in the art to combine the electrode materials of Nakanishi et al. with the angular velocity sensor of Fujii et al. as modified by Watanabe et al., and Shimada et al. for the benefit of preventing deterioration of the piezoelectric film and to improve the reliability of the sensor (Paragraph 63 of Nakanishi et al.).

Response to Arguments

9. Applicant's arguments filed 19 January 2010 have been fully considered but they are not persuasive.

10. Applicant argues that one of ordinary skill in the art would not look to the ferroelectric capacitor field for a teaching of a barrier layer for assistance in solving a problem in the angular velocity sensor field. However, the teachings derived from Watanabe et al. are not directed to its function as a ferroelectric capacitor. The teachings from Watanabe et al. are only its teachings regarding a diffusion barrier layer provided between the substrate and the adhesion layer for a lower electrode of a piezoelectric element. While their devices are used for different purposes, the structures of Fujii et al. and Watanabe et al. are very similar. Fujii et al. discloses a substrate having an adhesion layer, electrode layer, and piezoelectric layer stacked thereon. Watanabe et al. discloses a substrate with a diffusion barrier layer, adhesion layer, electrode layer, and piezoelectric layer thereon. Because of their structural similarities, it would be obvious to incorporate the diffusion barrier layer of Watanabe et al. into the angular velocity sensor of Fujii et al. It would be obvious to do so based on the teachings of Nakanishi et al., which discloses an angular velocity sensor having a diffusion barrier layer between a substrate and an adhesion layer, for the benefit of improving the reliability of the angular velocity sensor.

11. Applicant argues that one of ordinary skill in the art to combine the teachings of Fujii et al. and Shimada et al., as applicant argues that these two references are from different fields of endeavor. However, Shimada is relied upon only for its teaching of an

adhesion electrode for improving the strength of the bond between a piezoelectric layer and an upper electrode. Fujii et al. discloses a piezoelectric layer with an upper electrode without an adhesion layer; therefore, it would be obvious to include an adhesion layer, as taught by Shimada et al., for the benefit of improving the bond strength between the piezoelectric layer and upper electrode of Fujii et al.

Conclusion

12. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Derek J. Rosenau whose telephone number is (571)272-8932. The examiner can normally be reached on Monday thru Thursday 7:00-5:30.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Walter Benson can be reached on (571) 272-2227. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Derek J Rosenau/
Examiner, Art Unit 2837

/Walter Benson/
Supervisory Patent Examiner, Art Unit 2837